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Water Supply Planning

Santa Clara County Flood Control
and
Water Conservation District

ANNUAL SURVEY REPORT

on

GROUND WATER CONDITIONS

1964

March 1964

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santa clara county
FLOOD CONTROL AND WATER DISTRICT
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March 1964

Honorable Board of Supervisors
Santa Clara County Flood Control
and Water Conservation District
70 West Hedding Street
San Jose 10, California

Gentlemen:

I am pleased to transmit to you the District Engineer's "Annual Survey Report on Ground Water Conditions" in the Santa Clara County Flood Control and Water Conservation District for 1964. The report was prepared under the authority of Section 26.5 of the District Act and is the second of an annual series required as a prerequisite to the levy of a ground water charge for the production of water from the ground water supplies within a zone or zones of the District.

The report finds that an overdraft condition continues to exist throughout the major ground water basins of Santa Clara County. The average seasonal overdraft for the current (1963-64) water year was estimated to be 44,000 acre-feet for Zone W-1 (which covers most of the Santa Clara Valley Ground Water Basin), zero acre-feet for the Coyote Ground Water Basin, and 11,600 acre-feet for the Llagas Ground Water Basin. The accumulated overdraft as of the end of the preceding (1962-63) water year was estimated to be 564,000 acre-feet for the Zone W-1, and zero acre-feet for the Coyote and the Llagas Ground Water Basins. These overdrafts exist even though imported water from the Hetch-Hetchy Aqueduct of the City of San Francisco is available. There is no hope of any major alleviation of these annual overdrafts or amounts of accumulated overdrafts until additional supplemental imported water supplies are available.

Imported water will be available from the South Bay Aqueduct of the State Water Project in April 1965. The construction contract for the Central

Pipeline of the In-County Water Distribution System was advertised on 24 February 1964 and the construction of this pipeline should be completed in time to deliver imported water from the South Bay Aqueduct to the percolation areas of Penitencia and Los Gatos Creeks.

The report recommends continued construction and engineering design of the remainder of the In-County Water Distribution System in order that more supplemental water may be imported and put to effective use.

It is also recommended that a county-wide tax of five cents per $100 assessed valuation be levied in the ensuing (1964-65) water year to defray allocated costs of the South Bay Aqueduct, and that a ground water charge of $5 per acre-foot for agricultural extractions and $10 per acre-foot for municipal and industrial extractions be levied in the ensuing (1964-65) water year to finance the In-County Water Distribution System and the purchase of imported water from the South Bay Aqueduct.

I concur in the findings and recommendations presented in this report, and recommend that the suggested ad valorem tax and ground water charges be levied for the Fiscal Year 1964-65.

Sincerely yours,

Manager-Counsel

Acknowledgement

Valuable assistance and much of the data used in this investigation were contributed by agencies of the State of California and of the County of Santa Clara, by cities, and by private companies and individuals. This cooperation is gratefully acknowledged.

Special mention is made of the helpful cooperation of the Santa Clara Valley Water Conservation District, the South Santa Clara Valley Water Conservation District, the Sanitation Districts of Santa Clara County, the San Jose Water Works, and the Santa Clara County Planning Department.

SANTA CLARA COUNTY FLOOD CONTROL
AND
WATER CONSERVATION DISTRICT

Board of Supervisors
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Ralph H. Mehrkens
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INTRODUCTION

This is the second annual survey report on ground water conditions in the Santa Clara County Flood Control and Water Conservation District and the Zones thereof. It has been prepared in accordance with the requirements of Section 26.5 of the District Act.

The purpose of this report is to inform the District Board of Supervisors of the ground water conditions in the District during the preceding water year*, 1962-63, and to assist the Board in its determinations of water supply and water use as of the last day of this water year, 1963-64, and prediction of water supply and water use for the ensuing water year, 1964-65. This information will provide a basis for the Board's determination of ground water charges for the ensuing water year, 1964-65.

Ground Water Basins

The Santa Clara County Flood Control and Water Conservation District includes all of Santa Clara County. Within the County three major interconnected ground water basins have been delineated. These ground water basins are shown on Plate 1 "Ground Water Basins and Water Importation Zones in Santa Clara County," and have been named "Santa Clara

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*Water Year is defined in Section 26.1 of the District Act as "July 1st of one calendar year to June 30th of the following calendar year."

Valley Ground Water Basin," Coyote Ground Water Basin," and "Llagas Ground Water Basin." There are other ground water basins within the County, such as Antelope Valley in the northeastern corner, and many localized ground water supplies are tapped in the mountains and small valleys of the County. However, the use of these supplies at present is small and their development for use elsewhere is not economical. Therefore these basins are not considered further in this report.

For the purpose of estimating water supply amounts, it was assumed that the valley floor was the immediate ground water basin and the adjacent water bearing hill areas contribute to the water supply through a computed subsurface inflow; therefore, the values of water supply and ground water basin areas given herein relate to the valley floor.

Santa Clara Valley Ground Water Basin

The Santa Clara Valley Ground Water Basin is the most extensive, occupying about 173,000 acres between San Francisco Bay and the Lower Gorge on Coyote Creek just north of Coyote. It is also the most utilized ground water source, providing about 215,000 acre-feet of ground water extractions in 1962-63.

The Santa Clara Valley Ground Water Basin is separated from the Coyote Ground Water Basin to the south by a constriction in the bedrock, which is essentially non-water-bearing, at "The Narrows," a point just south of Metcalf Road and north of the small community of Coyote. Other than the constriction in cross-sectional area of the water bearing sediments there appears to be no barrier to the movement of ground water from one ground water basin to the other.

Coyote Ground Water Basin

The Coyote Ground Water Basin is the smallest of the three major basins; it occupies about 9,000 acres between "The Narrows" on the north and Cochran Road on the south. There is a subsurface high composed of older well indurated sediments and igneous rocks which forms a local divide just north of Morgan Hill and results in a decrease in the thickness of the water bearing sediments. Cochran Road generally follows this subsurface high which separates the Coyote Ground Water Basin from the Llagas Ground Water Basin to the south. Other than the reduction in the cross-sectional area of the water bearing sediments there appears to be no barrier to the movement of ground water from one basin to the other.

The Coyote Ground Water Basin is recharged primarily by the flows of Coyote Creek and Fisher Creek. Ground water moves out of this basin as subsurface flows both to the north through "The Narrows" and to the south over the subsurface high beneath Cochran Road. About 12,000 acre-feet of ground water were extracted in 1962-63 for use in this basin.

Llagas Ground Water Basin

The Llagas Ground Water Basin is the most southerly one in the Santa Clara County Flood Control and Water Conservation District. It extends from Cochran Road on the north to the Pajaro River on the south and occupies about 57,000 acres. In 1962-63 about 55,000 acre-feet of ground water were extracted from this basin for municipal and agricultural purposes.

Water Importation Zones

The only water importation zone in the District overlies essentially all of the Santa Clara Valley Ground Water Basin. This Zone was formed on 11 September 1962 and is known as Zone W-1. Its boundaries are shown on Plate 1.

Zone W-2 was formed on 11 February 1963, encompassing all water producing facilities that will benefit from the importation of water via the South Bay Aqueduct. The boundaries of Zone W-2 are conterminous with Zone W-1. Within Zone W-2 all water producing facilities are located, registered with the District, and a charge can be levied on water production to support the cost of importing and distributing supplemental water.

Water Supply

Precipitation and runoff measurements made at sampling stations in

Santa Clara County indicate that the water supply available during the 1962-63 water year was slightly above normal. Seasonal precipitation recorded by the U. S. Weather Bureau station at San Jose was about 145 per cent of the long-time mean of 14.09 inches while the precipitation station at Gilroy recorded about 130 per cent of the long-time mean of 20.01 inches. However, on a District-Wide basis the precipitation averaged about 112 per cent of the long-time mean.

Although runoff from streams originating on the west valley slopes in the Santa Cruz Mountains of Santa Clara County produced runoff volumes above the long-time average during the 1962-63 water year, runoff from streams originating in the Mount Hamilton Range on the east side of the valley was below normal. Therefore, although the precipitation was above normal, the total runoff available for recharge into the ground water basins was only about normal for the Santa Clara Valley and Coyote Ground Water Basins. Since primary source of runoff to the valley areas of the Llagas Ground Water Basin comes from the Santa Cruz Mountains, the total runoff available for ground water recharge there was above normal.

Runoff from west valley streams filled the surface reservoirs of the Santa Clara Valley and Llagas Ground Water Basins; however, below normal runoff from the east valley streams filled only a portion of the storage capacity in Anderson and Coyote Reservoirs. The total quantity of water stored in surface reservoirs for release during the 1963 irrigation season to the Santa Clara Valley Ground Water Basin was 38,400 acre-feet; in reservoirs of the Coyote Ground Water Basin, 53,600 acre-feet; and in reservoirs of the Llagas Ground Water Basin, 17,000 acre-feet.

Summary

In summary of the information contained in this report the total surface and subsurface water supply to Zone W-1 of the Santa Clara Valley Ground Water Basin during the 1962-63 water year was about 508,000 acre-feet, for the Coyote Ground Water Basin it was about 73,000 acre-feet, and about 231,000 acre-feet in the Llagas Ground Water Basin. The seasonal overdraft, which is the mean seasonal change in storage based on long term averages of water supply under present conditions, and the ground water extractions were estimated for each zone or ground water basin in the District. These estimates are:

GROUND WATER BASIN	OVERDRAFT (1963 conditions) in acre-feet	GROUND WATER PRODUCTION (1963) in acre-feet
Zone W-1	44,300	215,000
Coyote	Zero	12,000
Llagas	9,500	55,000

The accumulated overdraft in Zone W-1 as of the last day of the 1962-63 water year was based on the change in ground water storage between

1942 and the present. It was estimated to be about minus 564,000 acre-feet. The average annual change in ground water storage in Zone W-1 for the immediate past ten years was estimated to be plus 9,600 acre-feet.

In the management of ground water basins, the estimates of overdraft obtained within the assumed set of conditions can be used as a guide in reducing the amount of ground water extraction from these basins and in estimating the needs for imported water. Any reduction in the amount of extractions from the ground water basins to decrease or overcome the seasonal overdraft would require an equal amount of supplemental imported water. Estimates of the projected overdraft for each zone or ground water basin of the District in the water years of 1963-64 and 1964-65 are:

GROUND WATER BASIN	1963-64 OVERDRAFT in acre-feet	1964-65 OVERDRAFT in acre-feet
Zone W-1	44,000	32,700
Coyote	0	0
Llagas	11,600	12,300

The decrease in overdraft in Zone W-1 in 1964-65 represents the initial delivery of supplemental imported water through the South Bay Aqueduct of the State Water Project.

Based on the 1964-65 estimates of overdraft, there is a need for about 65,000 acre-feet of additional imported water to eliminate the average seasonal overdraft conditions and to provide for a planned 30-year elimination of the accumulated overdraft.

WATER SUPPLY AND WATER DISPOSAL

Within any water year the essential elements of water supply to the ground water basins of the District are precipitation on the valley land areas, surface and subsurface inflow, and surface import.

This water supply is disposed of by consumptive use including evaporation, surface and subsurface outflow, and surface export. These items of water supply and disposal will be discussed in the following paragraphs in order to develop the information essential to a determination of ground water overdraft, if any. The discussions attempt to relate the long time average seasonal amounts of water supply and disposal to what would be the average seasonal amounts of water supply and disposal if the present (1963) conditions had existed over the averaging period. These two averages permit a determination of the affects of today's activities of man if allowed to continue for a long time period.

The actual water supply and disposal in the 1962-63 water year is not considered in the determination of the average seasonal overdraft. However, it is of interest to compare actual occurrences with the significant long term averages. Thus a review was made of the actual annual water supply condition in 1962-63 and compared with the water disposal in that year to indicate the single year's surplus or deficiency in water supply.

Precipitation

Precipitation is the source of all water available for beneficial use in the District. Within the District it varies widely in total amount from place to place, from month to month, from year to year, and from one period of years to another. The average seasonal amount of precipitation varies from more than 45 inches along the crest of the Santa Cruz Mountains to less than 14 inches near San Francisco Bay.

The precipitation at San Jose was considered to be representative of the seasonal rainfall variations in the valley areas of Santa Clara County. These historical variations are shown on Plate 2 "Recorded Seasonal Precipitation and Accumulated Departure from the Average at San Jose." The curve of accumulated departure from the average seasonal precipitation on Plate 2 illustrates the historical successive periods of wetness (ascending curve) and dryness (descending curve).

The volume of precipitation that falls directly on the surface of a ground water basin is an item of direct water supply to that basin. However, it takes time to transmit this water to the ground water body below the ground surface. Therefore, to eliminate the time factor the amount of precipitation used as an item of water supply was estimated from the product of long time average seasonal rainfall and the area of the ground water basin or zone. The resulting values, which are estimates for the valley floor only, were 219,900 acre-feet for Zone W-1, 14,500 acre-feet for the Coyote Ground Water Basin, and 94,100 acre-feet for the Llagas Ground Water Basin. Precipitation on the hill areas within the ground water basins but outside of the valley floor area is accounted for in unmeasured stream flow and subsurface flow from the adjacent hills to the valley floor area.

The actual volumes of precipitation which fell on the valley floor area during the 1962-63 water year were 265,900 acre-feet for Zone W-1, 20,100 acre-feet for the Coyote Ground Water Basin, and 120,800 acre-feet for the Llagas Ground Water Basin. These actual volumes were about 125 percent of the long term mean.

Surface Inflow and Outflow

The surface water inflow, or runoff, to the zones or ground water basins of the District is a direct result of precipitation on the hill and mountain lands of the County. This water supply varies considerably, following the same long-term and seasonal trends as the rainfall. After the demands for evaporation, vegetative consumptive use, and deep percolation have been satisfied, the remaining volume of rainfall discharges over the surface of the ground as stream flow.

In Santa Clara County there is about 174,000 acre-feet of conservation storage space available in surface reservoirs, and portions of the stream flow runoff are made available as a source of water supply through conservation storage releases. Other portions of the runoff infiltrate naturally through the stream beds to the ground water reservoir or are used consumptively by native vegetation along the stream banks. The remaining volume of runoff discharges out of the County.

The long time average seasonal runoff into and out of the zones or ground water basins of the District is given in Table 1. The average seasonal surface inflow and outflow under present (1963) conditions is also given in Table 1.

TABLE 1

SURFACE RUNOFF INTO AND OUTFLOW FROM ZONES OR GROUND WATER BASINS OF THE SANTA CLARA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
in Acre-Feet

Ground Water Basin	Long Time Average Seasonal		Average Seasonal Under Present (1963) Conditions	
	Runoff Into	Outflow From	Runoff Into	Outflow From
Zone W-1	171,900	99,000	171,900	55,000
Coyote	67,000	55,100	67,000	45,100
Llagas	57,100	49,000	57,100	36,600

Under present (1963) conditions the surface inflow to the zones and ground water basins of the District remain the same as the long time average seasonal runoff since the works of man have little effect on the average runoff from the mountains. However, the works of man such as conservation reservoirs decrease the amount of surface outflow from the areas by holding back flood waters for future use while other works such as streets and roofs in urban areas generally increase the amount of surface runoff by increasing the impervious areas and reducing the opportunities for deep percolation. The estimated average change in surface outflow which occurred as a result of the activities of man between the end of the base period and the 1963 season are indicated by the difference between the figures in Columns 3 and 5 of Table 1.

Subsurface Inflow and Outflow

Subsurface inflow constitutes a part of the water supplies utilized in all of the zones and ground water basins of the District. Subsurface inflow into the Santa Clara Valley Ground Water Basin occurs from the adjacent hills, the Coyote Ground Water Basin, and from the Peninsula north of Adobe Creek when the ground water table in that area slopes toward the south. In the Llagas Ground Water Basin subsurface water enters from the Coyote Ground Water Basin to the north and from the adjacent hills. In the Coyote Ground Water Basin subsurface water enters only from the adjacent hills.

Based on data contained in Bulletin 7 of the California Department of Water Resources, it was estimated that the average seasonal subsurface inflow from the adjacent hills into the Santa Clara Valley Ground Water Basin was about 13,000 acre-feet. In addition, the average seasonal subsurface inflow from the Coyote Ground Water Basin was estimated to be 9,300 acre-feet. There is no subsurface outflow from the Santa Clara Valley Ground Water Basin since the ground water contours indicate subsurface inflow from all possible points of outflow, except the Palo Alto area where the ground water contours indicate no movement of water into or out of the basin. The subsurface inflow from San Francisco Bay is not a desirable condition and cannot be considered a part of the long term water supply since this inflow is a potential source of ground water quality degradation. Therefore, it is treated as a change in ground water storage and becomes a part of the accumulated overdraft.

The estimated average seasonal subsurface inflow from the adjacent hills to the Coyote Ground Water Basin was about 3,200 acre-feet. The average seasonal subsurface outflow from this basin was estimated to be 9,300 acre-feet to the north (to Santa Clara Valley Ground Water Basin) and 2,300 acre-feet to the south (to Llagas Ground Water Basin).

The estimated average seasonal subsurface inflow to the Llagas Ground Water Basin was about 10,500 acre-feet from the adjacent hills and 2,300 acre-feet from the Coyote Ground Water Basin. The historical ground water contours demonstrate that there is a subsurface outflow from the Llagas Ground Water Basin to the south and to the basins downstream along the Pajaro River. This subsurface outflow was estimated to be about 15,100 acre-feet on an average seasonal basis.

By extracting from or augmenting recharge to the ground water reservoir, man can influence the average seasonal amounts of subsurface inflow to or outflow from the ground water basins. For the purposes of this study it was assumed that under present (1963) conditions these influences had little or no effect on the subsurface inflow from the adjacent hills or the outflow from the Santa Clara Valley and Llagas Basins. However, near the common boundaries of the Coyote Ground Water Basin this influence has changed the configuration of the ground water contours sufficiently since the base period to result in a change of the average seasonal subsurface inflow or outflow under present (1963) conditions. The resulting average seasonal subsurface inflow and outflow values under present (1963) conditions for the zones and ground water basins of Santa Clara County are presented in Table 2.

TABLE 2

AVERAGE SEASONAL SUBSURFACE INFLOW AND OUTFLOW
TO ZONES OR GROUND WATER BASINS OF THE SANTA CLARA COUNTY
FLOOD CONTROL AND WATER CONSERVATION DISTRICT
in Acre-Feet

Ground Water Basin	Long-Time Average Seasonal		Average Seasonal Under Present (1963) Conditions	
	Subsurface Inflow	Subsurface Outflow	Subsurface Inflow	Subsurface Outflow
Zone W-1	22,300	0	27,800	0
Coyote	3,200	11,600	3,200	18,500
Llagas	12,800	15,100	14,200	15,100

Imported Water

An additional supply of water is provided to the Santa Clara County Flood Control and Water Conservation District by the purchase of imported water from the San Francisco Water Department by the cities of Milpitas, Mountain View, Palo Alto, and Sunnyvale. This importation grew from 860 acre-feet in 1939 to 24,300 acre-feet in 1963. Of this amount of imported water, 11,100 acre-feet was considered to be delivered and used in Zone W-1. There was no other imported water utilized in the zones or ground water basins of the District in 1963.

Consumptive Use

The primary item of disposal is the consumptive use of water in homes, in industry, by agriculture, and by native vegetation; it is also the item of water disposal that is most affected by the activities of man. The average seasonal consumptive use of applied water and precipitation within the zones or ground water basins of the District for the 1962-63 water year was estimated to be about 330,800 acre-feet in Zone W-1, 21,600 acre-feet in the Coyote Ground Water Basin, and 120,600 acre-feet in the Llagas Ground Water Basin.

These estimates were based on detailed land use studies and unit values of consumptive use. The information on land use was obtained from surveys conducted in 1961-62 by the Santa Clara County Planning Department adjusted to include areas of new urban development since than. Most

TABLE 3

LAND USE AREAS, UNIT VALUES OF CONSUMPTIVE USE, AND CONSUMPTIVE USE IN THE ZONES OR GROUND WATER BASINS, OF THE SANTA CLARA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

Zone W-1

Land Use	Area in Acres in 1962-63	Unit Consumptive Water Use in Feet	1962-63 Consumptive Use in Acre-Feet	Base Period Average Consumptive Use in Acre-Feet
Urban	89,700	1.8	161,500	20,600
Irrigated Land	64,900	2.5	162,200	211,200
Non-Irrigated Land	3,800	1.6	6,100	71,500
Farmstead	500	2.0	1,000	3,400
Miscellaneous	---	---	----	7,800
TOTAL	158,900*		330,800	314,500

Coyote Ground Water Basin

Land Use	Area in Acres in 1962-63	Unit Consumptive Water Use In Feet	1962-63 Consumptive Use in Acre-Feet	Base Period Average Consumptive Use in Acre-Feet
Urban	1,150	1.7	2,000	---
Irrigated Land	7,350	2.5	18,400	18,200
Non-Irrigated Land	700	1.6	1,100	1,300
Farmstead	30	2.0	100	---
Miscellaneous	---	---	---	800
TOTAL	9,230		21,600	20,300

Llagas Ground Water Basin

Land Use	Area in Acres in 1962-63	Unit Consumptive Water Use In Feet	1962-63 Consumptive Use in Acre-Feet	Base Period Average Consumptive Use in Acre-Feet
Urban	6,150	1.7	10,400	1,400
Irrigated Land	35,500	2.5	88,700	66,700
Non-Irrigated Land	14,250	1.4	20,000	27,800
Farmstead	400	2.0	800	1,200
Miscellaneous	1,000	0.7	700	2,900
TOTAL	57,300		120,600	100,000

*About 14,000 acres of marsh lands and water surface area not included.

of this new urban development occurred at the expense of irrigated farm land. The unit water use values associated with the various land use classes were derived from the values presented in Bulletin 7. The various classes of land use, acreages of each, the appropriate unit water use value, and the total estimated consumptive use for 1962-63 are presented in Table 3 for each zone or ground water basin in the District. Table 3 also contains the average seasonal consumptive use for the base period as determined in Bulletin 7.

Water Export

There is no direct export of water from the District. Sewage is disposed of from the urban centers of the north county to San Francisco Bay. The average seasonal discharge of sewage from Zone W-1 during the base period was about 12,000 acre-feet and in 1962-63 it was about 72,500 acre-feet. This large increase is indicative of the rapid urban expansion that has taken place. There is no sewage outflow from the Coyote Ground Water Basin.

In the Llagas Ground Water Basin, sewage from the City of Morgan Hill is treated and discharged to oxidation lagoons. Some of the effluent is used for irrigation; the remainder percolates to the ground water or is released to the Little Llagas Creek. Sewage from the City of Gilroy is treated and the effluent used for irrigation. However, the effluent surplus to the irrigation needs is discharged to Miller Slough and out of the basin. The average seasonal discharge of sewage from the Llagas Ground Water Basin, consisting primarily of effluent from the City of Gilroy, during the base period was estimated to be about 500 acre-feet and in 1962-63 it was about 700 acre-feet.

Water Supply Conditions in 1962-63

While not significant in the long term management of water resources, the actual water supply conditions during the past year is of interest. The items of water supply and water disposal for 1962-63 for the zones or ground water basins of the District are listed in Table 4. It indicates in general that the water supply met the needs for water during 1962-63 in all of the areas listed.

The values for 1962-63 in Table 4 can be matched with the significant long term average values under present conditions in Table 5 to see how 1962-63 ranked in comparison with the averages.

TABLE 4

SUMMATION OF THE ANNUAL ITEMS OF WATER SUPPLY & WATER DISPOSAL TO THE ZONES OR GROUND WATER BASINS OF THE SANTA CLARA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT FOR 1962-63

Values in Acre-Feet

Item	Ground Water Basin			Totals
	Zone W-1	Coyote	Llagas	
Water Supply				
Precipitation	265,900	20,100	120,800	406,800
Stream & Surface Inflow	203,600	48,500	96,000	348,100
Subsurface Inflow	27,800	4,300	14,200	46,300
Import	11,100	0	0	11,100
Subtotal (to be added)	508,400	72,900	231,000	812,300
Water Disposal				
Consumptive Use	330,800	21,600	120,600	473,000
Stream Outflow	98,200	29,600	62,000	189,800
Subsurface Outflow	0	18,500	15,100	33,600
Export (sewage)	72,500	0	700	73,200
Subtotal (to be subtracted)	501,500	69,700	198,400	769,600
Surplus (+) or Deficiency (-)	(+)6,900	(+)3,200	(+)32,600	42,700

Summary

As previously mentioned, the Santa Clara County Flood Control and Water Conservation District is dependent on the long term average seasonal water supply and surface import to meet the demands for water. As shown in Table 5 the sum of the items of disposal exceed the sum of the items of supply thereby indicating a long term withdrawal of water from storage. The amount of this loss and its effects will be discussed in the next chapter.

TABLE 5

SUMMATION OF THE AVERAGE SEASONAL ITEMS OF WATER SUPPLY AND WATER DISPOSAL UNDER PRESENT CONDITIONS TO THE ZONES OR GROUND WATER BASINS OF THE SANTA CLARA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
in Acre-Feet

Item	Ground Water Basin			Totals
	Zone W-1	Coyote	Llagas	
Water Supply				
Precipitation	219,900	14,500	94,100	328,500
Stream & Surface Inflow	180,600	67,600	57,700	305,900
Subsurface Inflow	27,800	4,300	14,200	46,300
Import	11,700	0	0	11,700
Subtotal(to be added)	440,000	86,400	166,000	692,400
Water Disposal				
Consumptive Use	330,800	21,600	120,600	473,000
Stream Outflow	81,000	47,100	39,100	167,200
Subsurface Outflow	0	18,500	15,100	33,600
Export (sewage)	72,500	0	700	73,200
Subtotal (to be subtracted)	484,300	87,200	175,500	747,000
Total*	(-) 44,300	(-) 800	(-)9,500	(-)54,600

*(-) indicates loss in storage

GROUND WATER CONDITIONS

The seasonal variations in water supply are regulated naturally by the large volumes of storage space in the ground water basins of the Santa Clara County Flood Control and Water Conservation District. As ground water is extracted from storage to meet water demands in excess of the average water supply, the ground water table lowers. A long time lowering of the ground water table indicates that ground water overdraft conditions exist and that the seasonal safe yield of the water supply has been exceeded. Such a condition exists in the District. In this chapter the ground water conditions will be noted and the amount of ground water overdraft derived.

Ground Water Table Conditions

Present and historical ground water conditions in the zones or ground water basins of the District are reflected in continuous records of the elevation of ground water in wells. The accumulated effect of ground water supply and disposal is shown by the changes from one year to another in the elevation of the ground water table. In the free or unconfined ground water areas, a change in the elevation of the water in a well reflects a change in the amount of water in storage while a similar change in the elevation of water in a well in an area of confined ground water reflects a change in the water pressure in the aquifer rather than a change in storage. In the Santa Clara Valley and Llagas Ground Water Basins there are large areas of confined ground water where changes in the elevation of water in deep wells does not indicate significant changes in ground water storage in the vicinity of the particular ground water elevation measurement. A study of the changes of ground water pressures in these areas when related to the changes in ground water elevations in the forebay zones indicates that the confined aquifers lack the capacity to transport ground water from the recharge zones (forebay) to the areas of discharge (wells) in the quantities presently being extracted without resulting in sea water intrusion.

Changes in the elevations of ground water in wells over a period of time at two locations in the Santa Clara Valley Ground Water Basin are shown on Plate 3, "Elevation of Ground Water in Wells." The location of these wells are shown on Plate 4, "Ground Water Contours, Fall 1963." As indicated on Plate 3, ground water elevations at well No. 7S/1E-35E in the forebay area have generally declined since 1958 at a rate of about eight feet per year. This represents a decrease in the amount of ground water in storage. However, well No. 6S/1W-27P in the pressure area demonstrates a more rapid rate of decline in the pressure surface, about 13 feet per year. This indicates that the present extractions of ground water from the pressure area requires a very steep slope in the ground water table or pressure surface to get the water from the area of recharge to the point of use. The only way that these pressure levels can be restored to an elevation safe from possible ground water quality degradation (sea water intrusion) is to reduce the extractions in the pressure area to some amount that can be transmitted from the forebay under a flatter ground water table or pressure surface slope.

The configuration of the ground water table or pressure surface is indicated by the contours on Plate 4. Ground water moves down slope perpendicular to the contours. The contours indicate subsurface inflow to the Santa Clara Valley Ground Water Basin from all directions, including San Francisco Bay. They also show subsurface movement of ground water southward out of the Llagas Ground Water Basin.

Changes in Ground Water Storage

As previously noted, the difference in the elevation of the ground water table from one year to another in a forebay or unconfined area represents a change in ground water storage. If the change in elevation is multiplied by the appropriate specific yield (the amount of water a saturated unit volume of water bearing sediment would yield under the pull of gravity) the result is the change in ground water storage.

A large accumulated loss of ground water from storage over a long period of time represents a condition of ground water overdraft. A ground water basin is in effect a reservoir and serves to regulate the seasonal variations in the water supply. In this capacity the elevation of the ground water table is expected to fluctuate, to be higher in periods of "wet" years and lower in periods of "dry" years. However, a lowering of the ground water table beyond that to be expected over a dry period is indicative of an overdraft condition.

While not significant in the long term water supply problem, it is interesting to note the changes in ground water storage that have occurred during the past year. This change can be evaluated by comparing the ground water table contours for 1962 with those of 1963. It does not provide a complete description of the change in storage since considerable time is required for water to transit between the surface of the ground and the ground water table. During the 1962-63 water year about 98,000 acre-feet was added to the ground water in storage in the Santa Clara Valley Ground Water Basin, zero acre-feet was added in the Coyote Ground Water Basin, and 46,700 acre-feet was added in the Llagas Ground Water Basin. These increases in ground water in storage reflect the above normal water supply in 1962-63.

Accumulated Overdraft

The accumulated overdraft represents the loss in ground water storage between a desirable elevation of the ground water table and its present elevation. It is not a measure of the amount of overdraft under present conditions but merely relates the noted change in storage of ground water.

If the ground water table elevation in 1942 is assumed the desirable condition which would prevent sea water intrusion and halt land subsidence, then the change in ground water storage between 1942 and the present is a measure of the accumulated overdraft in the Santa Clara Valley Ground Water Basin.

The change in ground water storage was computed by determining the average ground water table elevation for each square mile in the ground water basin for 1942 and 1963, subtracting that for 1963 from that for 1942, multiplying the difference by the appropriate specific yield, and accumulating the product with due regard to sign for each ground water basin. The resulting total accumulated change in storage as of the end of the preceding (1962-63) water year for Zone W-1 was about minus 352,000 acre-feet.

The removal of ground water from beneath the Bay is also a change in ground water storage. Its removal may invite sea water intrusion and loss of use of a portion of the ground water basin through water quality degradation. Although it may be a supply of water, its use is undesirable and cannot be continued. Under safe yield operation of the ground water basin this loss of ground water storage will have to be replaced and is, therefore, part of the accumulated overdraft.

Another change in ground water storage results from subsidence of the land surface. The release of ground water pressure in the confined areas has allowed ground water to be literally squeezed out of the confining layers of sediment. The loss in ground water storage is equal to the volume of land subsidence. It is also a part of the water supply but its use is undesirable since it results in the damaging land subsidence. However, this ground water storage is not replaceable and therefore, it is not considered to be part of the accumulated overdraft.

The accumulated overdraft is therefore the change in ground water storage computed above, and the change in storage resulting from the removal of ground water from under the bay. This latter change in storage is estimated to be minus 212,000 acre-feet for the Santa Clara Valley Ground Water Basin (Zone W-1). The accumulated overdraft as of 1963 was, therefore, about 564,000 acre-feet in Zone W-1.

In the Coyote Ground Water Basin the present (1963) ground water table is considered at a desirable elevation. Therefore, there is no accumulated overdraft in this ground water basin.

An inspection of the ground water contours for 1963 in the Llagas Ground Water Basin indicates that they are comparable with those of 1942, the year of assumed desirable ground water conditions in Zone W-1. The water resources of the Llagas Ground Water Basin have not been analyzed sufficiently to determine the desirable elevation of the ground water table there. However, assuming that ground water levels similar to the 1942 conditions are desirable, it would appear that there is no accumulated change in storage that can be used to measure accumulated overdraft, if any.

Past 10 Years Change in Ground Water Storage

The change in ground water storage for the immediate past 10 water years is a measure of recent historical events in the water supply and water disposal of the zones or ground water basins of the District. This is, in effect, an accumulated change in ground water storage that integrates the short term events of the past 10 years and is a measure of the average annual surplus or deficiency in water supply. Since only conditions of the past 10 years are included, this change in ground water storage also is not a measure of the amount of overdraft under present conditions nor does it necessarily relate to the average or base hydrologic period.

The change in ground water storage for the immediate past 10 water years was computed as previously discussed for the long term accumulated change in ground water storage and was found to total about plus 96,000 acre-feet for the major ground water basins of Santa Clara County. The individual basin changes in ground water storage for the 10 year period are shown in Table 6. The average annual change in storage over the same period is also shown in Table 6.

TABLE 6

ESTIMATED CHANGE IN GROUND WATER STORAGE BETWEEN 1953 AND 1963 AND AVERAGE ANNUAL CHANGE IN STORAGE FOR ZONES OR GROUND WATER BASINS OF THE SANTA CLARA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

Values in Acre-Feet

Ground Water Basin	Change in Ground Water Storage, 1953-1963	Average Annual Change in Ground Water Storage 1953-1963
Zone W-1	+47,000	+4,700
Coyote	+13,000	+1,300
Llagas	+36,000	+3,600
Total	+96,000	+9,600

+ Indicates recovery   - Indicates removal from storage

Average Seasonal Overdraft

For this study, the seasonal ground water overdraft is defined as the amount of ground water equal to the average annual decrease in the amount of ground water in storage that occurs during a long time period under a particular set of physical conditions affecting the supply, use, and disposal of water in the ground water basin. Overdraft is not to be confused with the seasonal surplus or deficiency in water supply. The latter represents the events of the year while the former relates the long term effects of variable water supply to disposal. The accumulated change in ground water storage is indicative of whether or not an overdraft condition exists, but it is not a measure of the amount of the overdraft. The overdraft is the average seasonal change in storage that would have occurred over a hydrologic base period if the present (or any particular year's) conditions had existed during that hydrologic base period.

The estimates of seasonal overdraft of the zones or ground water basins in the District were determined under a selected set of definitions, assumptions, and cultural conditions that appeared to best fit the actual conditions of water supply. In this study the base period to represent the long time average hydrologic conditions was that used in Bulletin 7. For the Santa Clara Valley and Coyote Ground Water Basins the base period was from 1935-36 through 1947-48 and for the Llagas Ground Water Basin from 1932-33 to 1947-48. These base periods were established by an analysis of the precipitation records for the San Jose and Gilroy stations.

The basic equation used was that the water supply must be equal to the water disposal plus or minus a change in storage. The solution to this equation is known as the hydrologic balance; that is, the hydrology of an area is balanced when the summation of the items of water supply is equal to the summation of the items of water disposal plus or minus a change in the amount of water in storage.

The base period hydrologic balance developed in Bulletin 7 for the North Santa Clara Valley area was modified to apply to the boundaries of Zone W-1 and the Coyote Ground Water Basin. The base period hydrologic balance for the Llagas Ground Water Basin developed in Bulletin 7 required no modification for use in this study. Each of the base period hydrologic balances were then adjusted to reflect the conditions as they existed in 1963. This was accomplished by subtracting the average seasonal amounts of each of the items of water supply and water disposal (as developed in the previous chapter and summarized in Table 5) which occurred under the fixed conditions of the present (1963) from the average seasonal amounts of the corresponding items of water supply and water disposal which occurred during the base period under actual conditions. The resulting differences were added to the average seasonal change in the amount of ground water in storage that occurred during the base period under actual conditions. This sum is the seasonal amount of ground water overdraft that would have occurred if present (1963) conditions had existed over the base period. These computations are presented in Tables 7, 8, and 9 for the zones or ground water basins of the District.

In the Coyote Ground Water Basin computations for the average seasonal overdraft under present (1963) conditions indicated a small overdraft. This computed overdraft was based on the decrease in ground water storage that occurred during the base period. Exclusive of this change in ground water storage, the hydrologic equation is essentially in balance; that is, water supply is sufficient to provide for the water disposal (see Table 5). Since the present (1963) elevation of the ground water table is deemed desirable for the agricultural pursuits of the area, the overdraft cannot be based on the change in ground water storage represented by the lowering of the ground water table to its present elevation. Therefore, under the present (1963) conditions there is no ground water overdraft in the Coyote Ground Water Basin, nor, for the same reason, is there any accumulated overdraft.

From these calculations it is apparent that ground water overdrafts existed in two of the three major ground water basins of the District. The average seasonal ground water overdraft under 1963 conditions in Zone W-1 (Santa Clara Valley Ground Water Basin) was 44,300 acre-feet, in the Coyote Ground Water Basin it was zero acre-feet, and in the Llagas Ground Water Basin it was 9,500 acre-feet.

Section 26.5 of the District Act directs that in addition to a determination of the overdraft for the previous water year, an estimate be made of the overdraft for the current and succeeding water years. The only items of water supply that could be expected to change are the amount of imported water, waste water disposal, and the amount of consumptive use; these are all items controlled by the activities of man. These items were estimated on the basis of historical information projected to the current (1963-64) and succeeding (1964-65) water years and average seasonal overdraft estimates were prepared in the same fashion as described for the preceding water year. The estimated average annual ground water overdraft as determined herein for the zones or ground water basins of the District are summarized in Table 10.

TABLE 7

ESTIMATE OF SEASONAL OVERDRAFT IN ZONE W-1
Under 1963 Conditions*
(In Acre Feet)

Items of Water Supply, Use and Disposal	Mean Seasonal Amount Under 1963 Conditions	Average Seasonal Amount Under Actual Conditions	Difference	Change in Storage
Average Seasonal Change in Storage During Base Period Under Actual Conditions				(-) 15,800
Surface & Subsurface Inflow				
Precipitation	219,900	219,900	0	
Stream & Overland Surface	171,900	171,900	0	
Imported Water	11,700	1,200	10,500	
Subsurface Inflow	27,800	22,300	5,500	
Waste Water Inflow	8,700	8,700	0	
SUBTOTAL (To be added)	440,000	424,000	16,000	(+) 16,000
Surface & Subsurface Outflow				
Consumptive Use of Applied Water & Precipitation	330,800	314,500	16,300	
Stream & Overland Surface	81,000	113,300	(-)32,300	
Exported Water	0	0	0	
Subsurface Outflow	0	0	0	
Waste Water Outflow	72,500	12,000	60,500	
SUBTOTAL (To be Subtracted)	484,300	439,800	44,500	(-) 44,500

SEASONAL OVERDRAFT (Mean Seasonal Change in Storage During Base-Period Under 1963 Conditions) (-) 44,300

*Estimate based on the auumption that the 13 year base period 1935-36 through 1947-48 is equal to a period of long-time water supply.

TABLE 8

ESTIMATE OF SEASONAL OVERDRAFT IN THE COYOTE GROUND WATER BASIN UNDER 1963 CONDITIONS*

(In Acre Feet)

Items of Water Supply, Use and Disposal	Mean Seasonal Amount Under 1963 Conditions	Average Seasonal Amount Under Actual Conditions	Difference	Change in Storage
Average Seasonal Change in Storage During Base Period Under Actual Conditions				(-) 700
Surface & Subsurface Inflow				
Precipitation	14,500	14,500	0	
Stream & Overland Surface	67,000	67,000	0	
Imported Water	0	0	0	
Subsurface Inflow	4,300	4,300	0	
Waste Water Inflow	600	500	100	
SUBTOTAL (To be Added)	86,400	86,300	100	(+) 100
Surface & Subsurface Outflow				
Consumptive Use of Applied Water & Precipitation	21,600	20,300	1,300	
Stream & Overland Surface	47,100	55,100	(-)8,000	
Exported Water	0	0	0	
Subsurface Outflow	18,500	11,600	6,900	
Waste Water Outflow	0	0	0	
SUBTOTAL (To be Subtracted)	87,200	87,000	200	(-) 200
SEASONAL OVERDRAFT (Mean Seasonal Change in Storage During Base-Period Under 1963 Conditions)				(-) 800

*Estimate based on the assumption that the 13 year base period 1935-36 through 1947-48 is equal to a period of long-time water supply.

TABLE 9

ESTIMATE OF SEASONAL OVERDRAFT IN THE LLAGAS GROUND WATER BASIN UNDER 1963 CONDITIONS*

(In Acre Feet)

Items of Water Supply, Use and Disposal	Mean Seasonal Amount Under 1963 Conditions	Average Seasonal Amount Under Actual Conditions	Difference	Change in Storage
Average Seasonal Change in Storage During Base Period Under Actual Conditions				(-) 900
Surface & Subsurface Inflow				
Precipitation	94,100	94,100	0	
Stream & Overland Surface	57,100	57,100	0	
Imported Water	0	0	0	
Subsurface Inflow	14,200	16,300	1,400	
Waste Water Inflow	600	500	100	
SUBTOTAL (To be Added)	166,000	164,500	1,500	(+) 1,500
Surface & Subsurface Outflow				
Consumptive Use of Applied Water & Precipitation	120,600	100,000	20,600	
Stream & Overland Surface	39,100	49,300	(-)10,700	
Exported Water	0	0	0	
Subsurface Outflow	15,100	15,100	0	
Waste Water Outflow	700	500	200	
SUBTOTAL (To be Subtracted)	175,500	165,400	10,100	(-)10,100
SEASONAL OVERDRAFT (Mean Seasonal Change in Storage During Base-Period Under 1963 Conditions)				(-) 9,500

*Estimate based on the assumption that the 16 year base period 1932-33 through 1947-48 is equal to a period of long-time water supply.

TABLE 10

ESTIMATED AVERAGE SEASONAL GROUND WATER OVERDRAFT FOR ZONES OR GROUND WATER BASINS OF THE SANTA CLARA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

in Acre-Feet

Ground Water Basin	Average Annual Ground Water Overdraft		
	1962-63	1963-64	1964-65
Zone W-1	44,300	44,000	32,700*
Coyote	0	0	0
Llagas	9,500	11,600	12,300

* 11,000 AF of South Bay Aqueduct water will be percolated into the underground during the 1964-65 water year.

Average Annual Overdraft for Past 10 Years

The average annual overdraft for the past 10 years is requested by Section 26.6 of the District Act. This value was estimated by taking the determination of annual overdrafts, if any, for 1954-55 and 1963-64 and averaging them. No attempt was made to evaluate the intervening years' overdraft because of the difficulties involved and a simple straight line projection should give reasonable results considering the accuracy of the available data. The computation and averages are given in Table 11.

TABLE 11

AVERAGE ANNUAL OVERDRAFT FOR PAST 10 YEARS

in Acre-Feet

Ground Water Basin	Overdraft Under Conditions of 1954-55	Overdraft Under Conditions of 1963-64	Average Annual Overdraft of Past 10 Years
Zone W-1	14,000	44,000	29,000
Coyote	0	0	0
Llagas	0*	11,600	4,300

*Indications were that supplies exceeded draft by 3,000 AF.

Ground Water Extractions

While ground water supplies provide for the large majority of the beneficial uses in the Santa Clara County Flood Control and Water Conservation District, the amount of ground water extraction is not a necessary item of the hydrologic equation. This anomaly occurs because ground water extraction is an item of water supply and also an item of disposal from the ground water reservoir; as a result, it would appear on both sides of the hydrologic equation and automatically cancels.

However, the amount of ground water extraction is a necessary item to the management of a ground water basin. Ground water extractions should be limited to the average seasonal safe yield of the ground water basin. This safe yield is based on the amount of local and imported water available and the capacity of the ground water basin to accept and deliver the required amounts of water.

It appears from preliminary studies that the Santa Clara Valley Ground Water Basin can not accept the required amount of imported water to overcome the ground water overdraft. It also appears that the capacity of the ground water basin to deliver water under a reasonable hydraulic gradient from the points of recharge to the places of use is limited by the physical characteristics of the basin. Therefore, to effectively overcome the overdraft a reduction in ground water extraction is in order. This reduction in extractions should be effected first in those areas where the capacity of the aquifers to transmit water is low.

The water supply in those areas would have to be supplemented by surface delivered water. It will require considerable detailed study of the operational characteristics of the Santa Clara Valley Ground Water Basin to bring the area into a managed water resources concept.

In order to provide reliable data on the location and amount of ground water extraction records of ground water production should be kept. In general, this has not been done for any of the agricultural uses; only some of the industrial uses and mutual water companies have adequate records, but fortunately the large private water companies (public utilities) and municipal water systems do keep good records. In the future, records of ground water extraction for all uses will be improved as a result of the ground water charge to be placed on all ground water produced in Zone W-2. Attempts should be made to improve the records for the other ground water basins to facilitate planning for future water importation and improved ground water basin management.

Based on the acreage of land irrigated, type of crop, and an assumed irrigation efficiency, it is possible to estimate the amount of ground water extracted for agricultural use. Utilizing the records of public utilities and municipal water systems and adding a small percentage for unmetered ground water production outside of those systems, it is possible to estimate the amount of ground water extracted for urban (municipal and industrial) use. However, the seasonal amount and time of occurrence of precipitation affects to a marked degree the amount of ground water extracted for use in irrigation. Therefore, estimates of ground water extractions must be based on averages.

By these methods, the ground water extraction for past years was estimated and extended by proportional projection to the current and ensuing water years. These amounts of estimated ground water extraction are shown in Table 12. The large apparent difference between 1962-63 and 1963-64 is based on the effect of the above normal rainfall in 1962-63 and the fact that rains in the spring of 1963 eliminated the need for one normally applied irrigation. In an average year the extractions are as given for 1963-64.

TABLE 12

ESTIMATED SEASONAL GROUND WATER EXTRACTIONS
IN THE ZONES OR GROUND WATER BASINS OF THE
SANTA CLARA COUNTY FLOOD CONTROL
AND WATER CONSERVATION DISTRICT
in Acre-Feet

Ground Water Basin	Zone W-1	Coyote	Llagas	Total
1962-63				
Agricultural Use	95,000	10,000	46,000	151,000
Urban Use	120,000	2,000	9,000	131,000
Total	215,000	12,000	55,000	282,000
1963-64				
Agricultural Use	109,000	13,000	64,000	186,000
Urban Use	130,000	2,000	11,000	143,000
Total	239,000	15,000	75,000	329,000
1964-65				
Agricultural Use	101,000	13,000	65,000	179,000
Urban Use	138,000	3,000	12,000	153,000
Total	239,000	16,000	77,000	332,000

WATER IMPORTATION PROGRAM

In the preceding chapter it was estimated that the average seasonal ground water overdraft in the District in the current (1963-64) water year will be about 55,600 acre-feet and that by the end of the current (1963-64) water year the accumulated ground water overdraft will amount to about 620,000 acre-feet. The fact that ground water overdraft conditions have existing for some time is well known. As indicated by the descending line of the accumulated departure from the average seasonal precipitation on Plate 2, the period from 1917 to 1935 was a period of dryness or below average rainfall. This "drought" caused enough concern over the water supply problem to permit the formation of the Santa Clara Valley Water Conservation District in 1929. That district immediately began conservation activities and by 1935 had completed its first conservation reservoir. The conservation measures and the "wet" period of above average rainfall from 1935 to 1942 resulted in an essentially full ground water reservoir in 1942.

However, these efforts at conserving the local water supply could not keep up with the increasing demand for water. The descending line on Plate 2 for the period between 1942 and 1950 is not as extensive as the period between 1917 and 1935 indicating that the 1942-50 "dry" period was less severe. And yet the ground water table reached an all time low in 1950'. Clearly the local water supply is insufficient to provide for the demands made upon it.

Recognizing this fact, the Board of Supervisors of the Santa Clara County Flood Control and Water Conservation District contracted with the State of California in 1962 for a supplemental water supply of 88,000 acre-feet per year. A re-evaluation of future water requirements and sources of supply led to a decision of the District Board to increase the maximum entitlement under the contract to 100,000 acre-feet. The contract was amended to this entitlement on December 16, 1963. This water will be delivered through the South Bay Aqueduct of the State Water Project and initial water delivery is scheduled for April, 1965.

In order to put this water to the most efficient use some will be delivered to the facilities of the Santa Clara Valley Water Conservation District for recharge of the ground water supplies. Because of the apparent limitations of the ground water basin to deliver the needed amount of water, the remainder will be treated and delivered to water retail agencies for direct surface delivery to consumers. This is an essential part of the ground water management program to relieve the overdraft on the ground water basin caused by the inadequate transmission capacity of its aquifers. Under the pricing policy recommenced by the Santa Clara County Water Commission and adopted by the District Board of Supervisors the delivery of treated water will be delayed until contracts assuring repayment of the treated water facilities is assured. Until that time all imported water will be used to recharge the ground water basin.

Based on the average annual overdraft and accumulated overdraft described in the preceding chapter, supplemental water should be imported this year to alleviate these undesirable conditions. Based on the estimates of overdraft for the succeeding (1964-65) water year about 56,000 acre-feet of supplemental water should be imported if available and, in addition, about 20,000 acre-feet of water should be imported to help alleviate the accumulated overdraft (planned elimination in 30 years). However, only about 11,000 acre-feet of supplemental imported water will be available in 1964-65. This amount will increase in future years.

Pricing Policy

To pay for the District's share of the South Bay Aqueduct and the In-County Water Distribution System required to service this imported water, a limited county-wide ad valorem tax and a ground water charge on water extracted or surface water delivered in lieu of extraction within Zone W-1 will be levied. In addition, charges for treated water will be made that will repay all the costs of the treatment plants, their operation and maintenance, their share of the In-County Distribution system costs, and the assigned ground water charge. The Board of Supervisors have adopted a plan to limit the ad valorem tax to five cents per $100 of assessed valuation and to fix the ground water charge for water derived from the ground water supplies of Zone W-1 for agricultural use to $5.00 per acre-foot. The ground water charge on water derived from the ground water supplies of Zone W-1 for any use other than agricultural (termed municipal and industrial water use), will vary according to the anticipated expenditures and revenues from the other sources, but this component of the ground water charge can not exceed $20.00 per acre foot. When the variable component of the ground water charge is $10.00 per acre-foot and should the total anticipated revenues from all sources exceed the anticipated expenditures in any year, the ad valorem tax will be reduced to zero before the ground water charge is reduced below $5.00 per acre-foot for agricultural water and $10.00 per acre-foot for municipal and industrial water.

Costs and Revenues

Since a large portion of the South Bay Aqueduct is constructed and in operation and the remainder is under construction, payments must be made to the State for the District's share in the construction and maintenance of completed portions of the aqueduct. The first ad valorem tax of five cents per $100 assessed valuation was levied by the District Board of Supervisors for the water year 1961-62, however, no payments were made to the State. During the 1962-63 water year payments were

$315,000 and for the current (1963-64) water year payments will be about $570,000. If the five cents per $100 assessed valuation ad valorem tax is levied and collected for the ensuing (1964-65) water year, it is estimated that about $700,000 would be obtained. It is also anticipated that during this period payments to the State will be about one million dollars. Including the estimated carry-over of ad valorem taxes collected in previous years there will be insufficient funds from the ad valorem tax to pay the estimated 1964-65 State charges. Therefore, it will be necessary to obtain revenues from other sources, including the ground water charge, to meet the estimated payment commitments.

The engineering and construction costs of the In-County Distribution System, including the water treatment plant costs, will be paid from the proceeds of the District's successful bond issue of $42,050,000 passed by the voters in June of 1963. Bonds sold for engineering and construction will be repaid from the ground water charges and the sale of treated water. In January, 1964, the first increment of bonds, totaling 15.5 million dollars, was sold to finance the total costs of the first planned phase of construction. Portions of this sale were reinvested in short term securities terminating when payments are due for work completed. Engineering for the first phase construction of the In-County Water Distribution System (Central Pipeline) is complete and the project was advertised for bids on 24 February, 1964. Payments of $799,000 have been made for this work. Engineering on the remaining components of the first phase of construction will be completed during the 1964-65 water year.

In order to collect the ground water charges, it is necessary to know the amount of ground water extractions and the names of the extractors. Registration of all wells in Zone W-2 began on February 11, 1963 with the formation of the Zone, coterminus with Zone W-1, as a prerequisite to the levying and collection of a ground water charge. The work of well registration, locating and coding, is essentially complete and specifications for the installation of water measuring devices on a portion of all registered wells have been drafted.

During this registration period a study was initiated to establish the most economical method or combination of methods for determining well production, and at the same time resulting in the highest net return of the ground water charge. The results of this study were presented in a report on "Costs and Methods of Determining Ground Water Production, published in December, 1963. Starting in the current (1963-64) water year, water measuring devices will be installed on high production agricultural wells. However, it is not possible to complete this work prior to the beginning of the 1964-65 water year.

A portion of the local and imported water delivered on the surface within Zone W-2 for agricultural and municipal purposes will be subject to a charge. The pricing policy for the agricultural component of this water was recommended in a report on "Pricing of Surface Delivered Agricultural Water", published in January 1964. Measuring methods similar to those used to establish ground water extractions will be used to measure surface deliveries.

Recommended Ground Water Charges

Expenditures during the current (1963-64) water year will be made from ad valorem tax revenues and bond sales. Since bond revenues are restricted to engineering and construction payments in the ensuing (1964-65) water year, additional revenues will be required to meet the estimated State charges, operation costs, and bond retirement payments, including interest, that are not met by the ad valorem tax or interest on investment of bond proceeds. Therefore, it will be necessary to levy and collect a ground water charge in the 1964-65 water year.

Because of the difficulties encountered in the registration of wells, the installation of meters on agricultural wells will not be complete until after the irrigation season; therefore, it will be necessary to estimate agricultural extractions for a portion of the 1964-65 water year. A substantial number of municipal and industrial wells are presently metered and reliable extraction quantities should be obtainable for this period.

Financial operation studies, based on conservative estimates of revenue and payments to be made during the current and ensuing water years, were completed for the first years of operation. Ground water charges for the succeeding (1964-65) water year of $5 per acre foot for agricultural extractions and $10 per acre foot for municipal and industiral extractions are estimated to produce revenues adequate to meet all payments during that water year, provided a five cents per $100 assessed valuation ad valorem tax is also levied and collected.

SUMMARY OF FINDINGS AND RECOMMENDATIONS

Pursuant to Section 26.5 of the Santa Clara County Flood Control and Water Conservation District Act, an investigation of the ground water conditions of the District and Zones thereof has been completed. This chapter presents a summary of the findings derived from the results of this investigation and recommendations based upon these findings.

Summary of Findings

1. The major ground water basins of the Santa Clara County Flood Control and Water Conservation District are the Santa Clara Valley Ground Water Basin in the northern portion of the County, the Coyote Ground Water Basin in the center of the District, and the Llagas Ground Water Basin in the southern portion of the District.

2. A water importation zone, Zone W-1, was established on September 11, 1962. It includes most of the Santa Clara Valley Ground Water Basin within its boundaries.

3. The average seasonal water supply available to the zones or ground water basins of the District under present (1963) conditions is:

Zone W-1	440,000 acre-feet
Coyote G. W. B.	86,400 acre-feet
Llagas G. W. B.	166,000 acre-feet

4. The average seasonal water disposal including consumptive use in the zones or ground water basins of the District under present (1963) conditions is:

Zone W-1	484,300 acre-feet
Coyote G. W. B.	87,200 acre-feet
Llagas G. W. B.	175,500 acre-feet

5. Under the present (1963) conditions of water supply and water disposal, overdraft conditions exist in two of the three major ground water basins of the District. The average seasonal overdraft in acre-feet for the preceding (1962-63), current (1963-64) and ensuing (1964-65) water years is estimated to be:

Zone W-1	44,300	44,000	32,700
Coyote G. W. B.	0	0	0
Llagas G. W. B.	9,500	11,600	12,300

6. The accumulated overdraft represented by the change in ground water storage between the ground water table elevation in 1942 (assumed desirable) and 1963 is estimated to be:

Zone W-1	564,000 acre-feet
Coyote G. W. B.	0 acre-feet
Llagas G. W. B.	0 acre-feet

7. The primary source of water put to beneficial use in the zones or ground water basins of the District is ground water and the total extractions in acre-feet of ground water during the preceding

(1962-63), current (1963-64) and ensuing (1964-65) water years is estimated to be:

Zone W-1	215,000	239,000	239,000
Coyote G. W. B.	12,000	15,000	16,000
Llagas G. W. B.	55,000	75,000	77,000

8. The estimated amount of ground water to be extracted for agricultural use from the zones or ground water basins of the District during the ensuing (1964-65) water year is:

Zone W-1	101,000 acre-feet
Coyote G. W. B.	13,000 acre-feet
Llagas G. W. B.	65,000 acre-feet

9. The estimated amount of ground water to be extracted for uses other than agricultural use from the zones or ground water basins of the District during the ensuing (1964-65) water year is:

Zone W-1	138,000 acre-feet
Coyote G. W. B.	3,000 acre-feet
Llagas G. W. B.	12,000 acre-feet

10. A program for the importation of supplemental water to help alleviate the annual and accumulated ground water overdraft has been formulated and a contract signed with the State to supply a maximum annual amount of 100,000 acre-feet. Initial deliveries are to be made in early 1965 from the South Bay Aqueduct.

11. An In-County Water Distribution System to deliver the imported water to the points of ground water recharge and surface delivery treatment plants in Zone W-1 is being designed. Design of the Central Pipeline is complete and the project was advertised for bids on 24 February, 1964.

12. The registration of wells in the zone W-2 is complete and the installation of meters on agricultural wells will start in the latter part of the current (1963-64) water year. Completion of this work will be in the ensuing (1964-65) water year.

13. Expenditures for Santa Clara County's share of the cost of construction of the South Bay Aqueduct in the ensuing (1964-65) water year are estimated to amount to $1,000,000.

14. A county-wide ad valorem tax of five cents per $100 assessed valuation together with anticipated carryover from the current water year will not provide sufficient revenues in the ensuing (1964-65) water year to meet the anticipated expenditures.

15. A ground water charge based on estimated production of water from the ground water supplies in Zone W-2 of $5 per acre foot for agricultural extractions and $10 per acre foot for municipal extractions is necessary to meet anticipated expenditures in the ensuing (1964-65) water year.

Recommendations

Based on these findings it is recommended:

1. That the District continue expeditiously its engineering design work on the remainder of the In-County Water Distribution Facilities in order to complete the system in time to distribute larger quantities of imported water available from the South Bay Aqueduct.

2. That a county-wide ad valorem tax of five cents per $100 assessed valuation be levied for the ensuing (1964-65) water year and collected to pay a portion of the anticipated charges for the County's share of the construction and maintenance of the South Bay Aqueduct.

3. That a ground water charge of $5 per acre foot for agricultural extractions and $10 per acre foot for municipal and industrial extractions be levied and collected in Zone W-2 for the ensuing (1964-65) water year to pay the remaining charges for the South Bay Aqueduct and the bond charges for the In-County Water Distribution System.

4. That the District Board of Supervisors make the following determinations for Zone W-2 in accordance with Section 26.6 of the District Act:

   a. The average annual overdraft as determined by the long term overdraft under present (1954-55 and 1963-64) conditions for the immediate past 10 water years is about 29,000 acre-feet.

b. The estimated annual overdraft for the current (1963-64) water year is about 44,000 acre-feet.

c. The estimated annual overdraft for the ensuing (1964-65) water year is about 32,700 acre-feet.

d. The accumulated overdraft as of the last day of the preceding (1962-63) water year is about 564,000 acre-feet.

e. The estimated accumulated overdraft as of the last day of the current (1963-64) water year is about 608,000 acre-feet.

f. The estimated amount of agricultural water to be withdrawn from the ground water supplies of Zone W-1 for the ensuing (1964-65) water year is about 101,000 acre-feet.

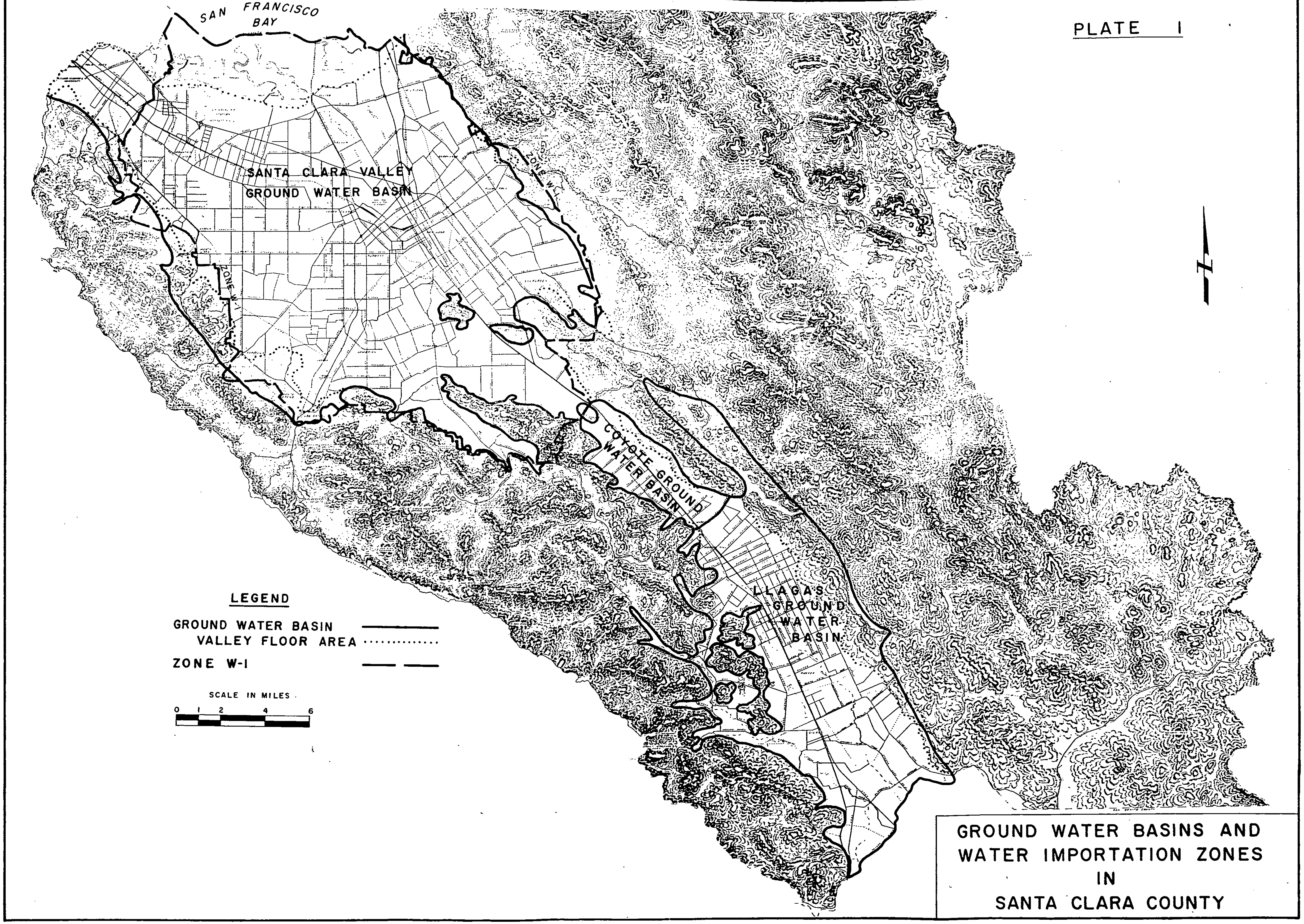
g. The estimated amount of water other than agricultural water to be drawn from the ground water supplies of Zone W-1 for the ensuing (1964-65) water year is about 138,000 acre-feet.

h. Imported water supplies will be available to the District in the ensuing (1964-65) water year but without water treatment only about 500 acre-feet of water can be delivered on the surface.

i. If available, about 64,000 acre-feet of supplemental water should be imported to recharge the ground water basins of Zone W-1 in the ensuing (1964-65) water year. However, only about 11,000 acre-feet of water is scheduled to be imported through the South Bay Aqueduct for replenishment of the ground water supplies in the ensuing (1964-65) water year.

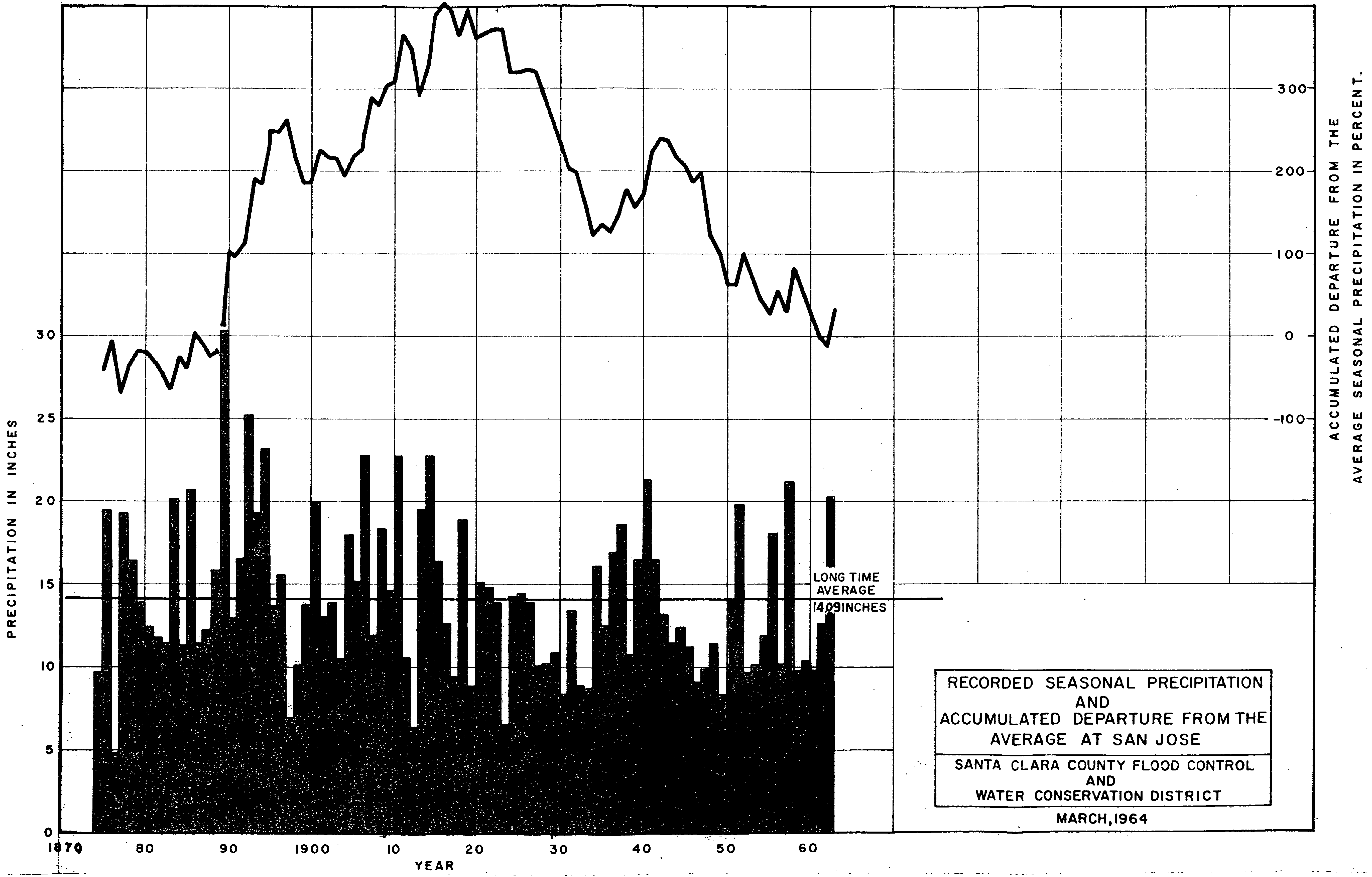
j. The District is obligated by contract to purchase about 11,000 acre-feet of water in the ensuing (1964-65) water year.

PLATE I



GROUND WATER BASINS AND WATER IMPORTATION ZONES IN SANTA CLARA COUNTY

PLATE 2

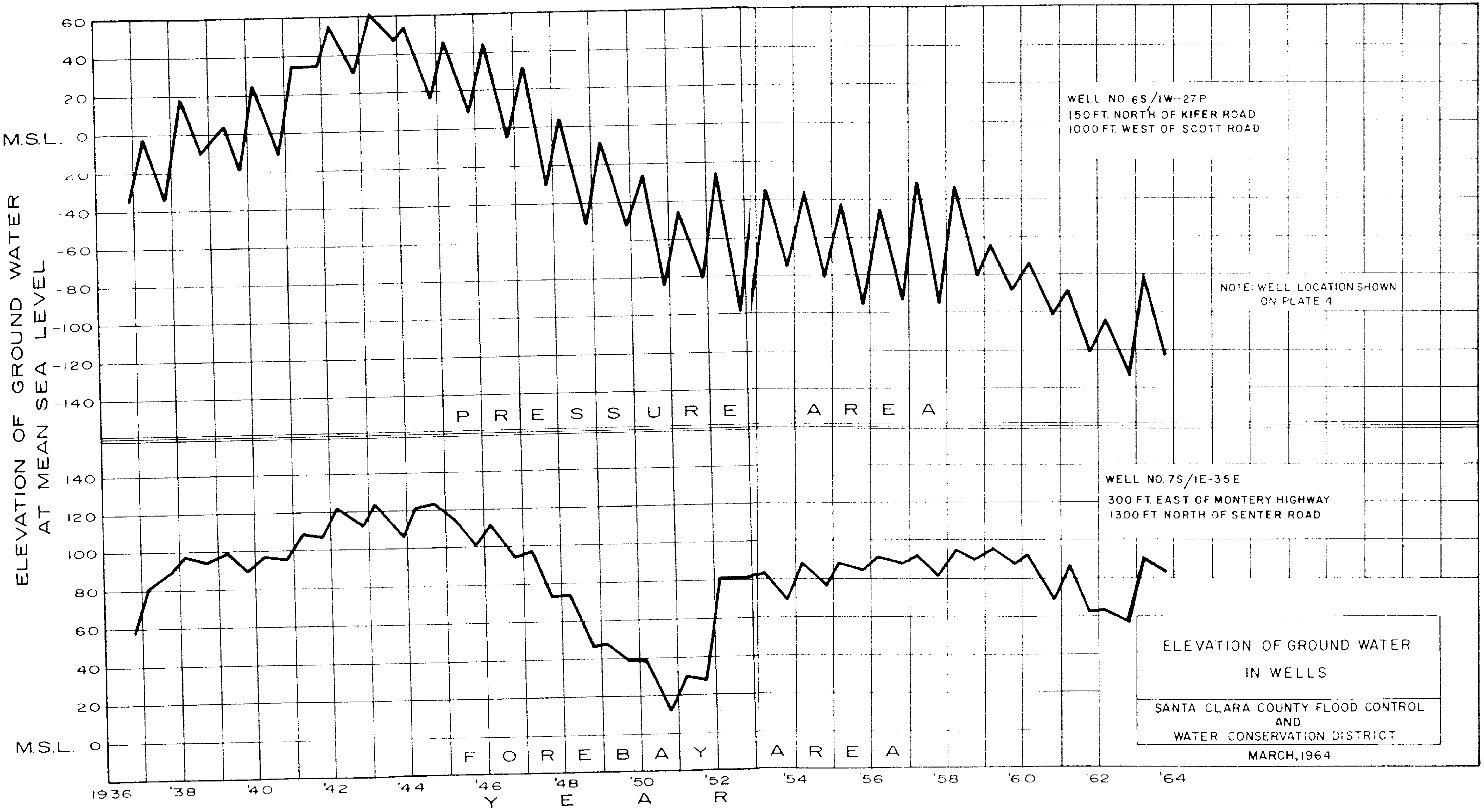


RECORDED SEASONAL PRECIPITATION
AND
ACCUMULATED DEPARTURE FROM THE
AVERAGE AT SAN JOSE

SANTA CLARA COUNTY FLOOD CONTROL
AND
WATER CONSERVATION DISTRICT

MARCH, 1964

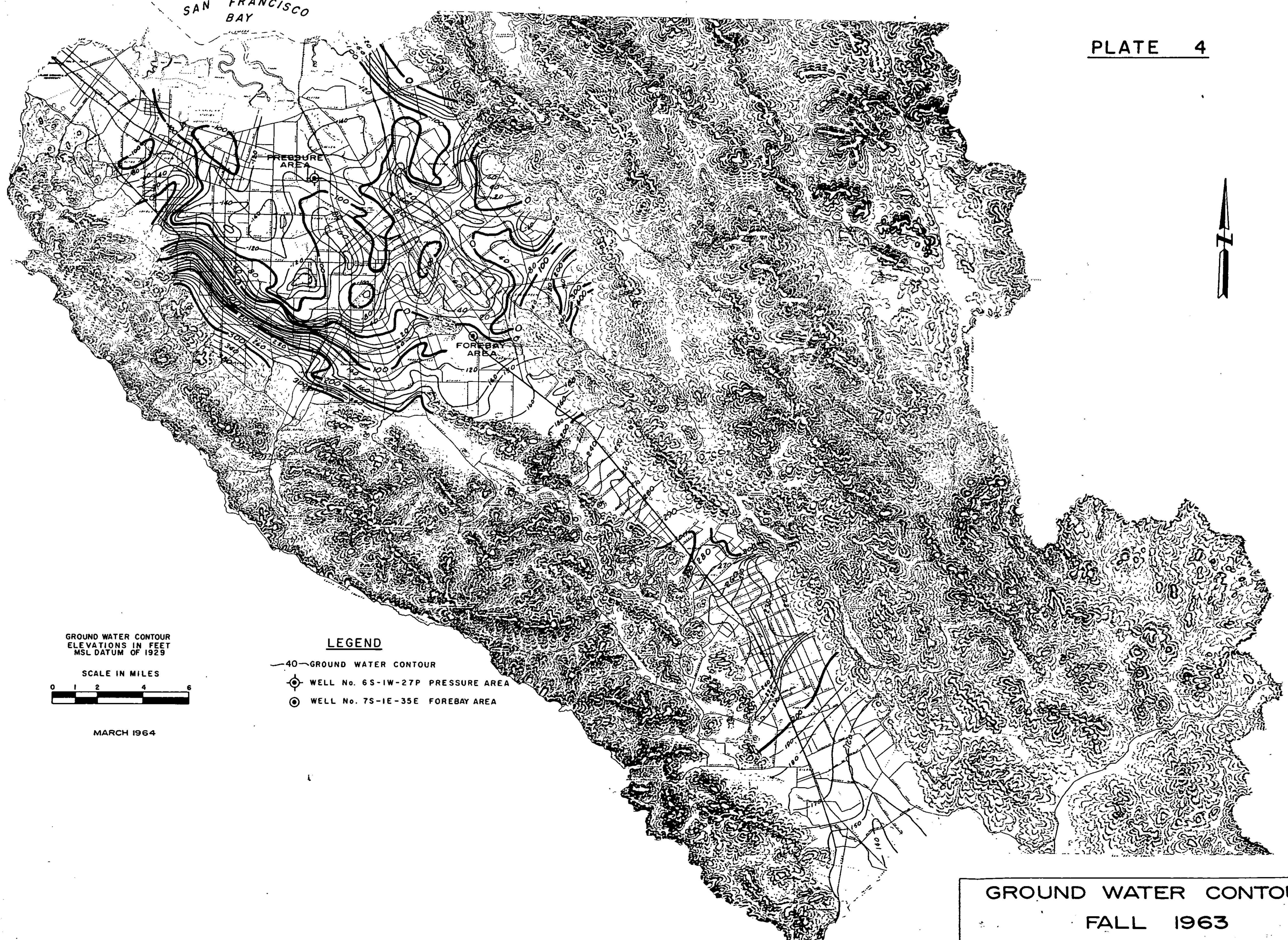
PLATE 3



ELEVATION OF GROUND WATER
IN WELLS

SANTA CLARA COUNTY FLOOD CONTROL
AND
WATER CONSERVATION DISTRICT
MARCH, 1964

PLATE 4



GROUND WATER CONTOUR
ELEVATIONS IN FEET
MSL DATUM OF 1929

SCALE IN MILES
0 1 2 4 6

MARCH 1964

LEGEND

—40— GROUND WATER CONTOUR

WELL No. 6S-1W-27P PRESSURE AREA

WELL No. 7S-1E-35E FOREBAY AREA

GROUND WATER CONTOURS
FALL 1963
SANTA CLARA COUNTY